Popularization of Science among International Students in Ukraine

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Abstract. The purpose of the article is to identify and substantiate the pedagogical conditions for the forming a model of a modern technical specialist with a high level of professional skills, and skills of transforming scientific data, incomprehensible to the ordinary people into interesting and understandable information that will promote greater attraction from young people to scientific problems. The necessity of forming a professionally oriented world outlook for international students in their future scientific and technical activity by using interactive pedagogical technologies of science's popularization such as: distance courses of science popularization; integration of the academic subjects and extracurricular activities in a technical university with creating a learning environment aimed to a modern technical specialist forming, is substantiated.

Keywords. Integration Training, Model of Modern Technical Specialist, Pedagogical Conditions, Popularization of Science.

1. Introduction

The interest in scientific work and engineering professions has significantly decreased in recent years. This situation is typical for many countries, and, of course, for Ukraine. All over the world, scientists and researchers are trying to solve the problem of "science popularization", to encourage young people in obtaining scientific knowledge and conducting scientific research, forming scientific skills. Scientific festivals and theaters, Internet conferences, online interviews of scientists, news, magazines, books, radio and TV programs and many others are used to solve this problem.

Stephen Hawking emphasized the fact that it is very important to create public interest at least about those scientific areas that are very interesting to study [1-4]. He noted that science is often taught in not very interesting form. Young people do not see the connection between science and the world around them; they learn only to pass the exams. Hawking also said that teachers should actively promote science among students and schoolchildren, underlining that the development of science and technology is possible only if the interest in society in these areas of activity is high enough [5]. It is advisable to use the whole arsenal of modern means, in particular, the Internet, mobile communication opportunities, advertising, etc.

2. Recent research and publications analysis

Nowadays Europe builds a knowledge-based economy, because Europeans understand that progress is impossible without implementing scientific research. The world has reached such a degree of development, when society absolutely needs a threshold of knowledge that guarantees security and a new quality of life [6]. That's why there are many programs for increasing interest in science by the public. One of the most popular is the Horizon 2020 program with a budget of 17.5 billion euros. Moreover, the European and American Funds of Science conducted a joint study to analyze the problem of popularizing science in different countries of the world. The results showed that in the United States scientific popularization has been put on a very high level [7].

In addition, the United Kingdom also should be noted as the state provides significant support for popularization of science: a special commission whose purpose is to explain to people why science is important and a special TV channel, which deals exclusively with the promotion of scientific knowledge, were created. The European Center for Science and Art named Alpha Galileo Press was organized [8]. Among many popular European publications, it should be noted British Journals Nature and New Scientist, which provide information about scientific achievements, and even the only publication in these journals is often considered more valuable for scientists than dozens of articles in other editions [9-10]. As a result, the interest of great part of British youth is directed toward the natural sciences.

Scientists all around the world propose to follow some basic principles of effective

science promotion. Among them are the following:

- Adaptation of a complex scientific phenomenon to some essential formula depending on the audience.
- Using the principle of analogy like comparing the scientific phenomenon with everyday life, so that the first became clear.
- Making messages about scientific phenomenon with emotional attitude.
- Clear balance of depth of detail and calculation of the uninformed reader, rigorous dosing of the message logic.

3. Objective

A large number of students from more than 148 countries study in Ukraine. An important condition for improving the popularization of science among international students is their awareness, possibility of access to specific scientific information adapted for them especially in the first stage of studying. Scientists of Ukraine are exploring the effective ways of solving the problem of science popularization among international students, but, unfortunately, these issues still require careful attention from researchers and teachers.

The objectives of the paper are as follows:

- providing foreigners with systematic knowledge of the famous scientific inventions both in Ukraine and all over the world;
- acquaintance with the peculiarities of educational process associated with various scientific areas and scientific research;
- development a comprehensive psychological and pedagogical program for the science popularization as a tool for increasing the effectiveness of international students' adaptation to new living conditions, as well as the prevention of extremism and xenophobia.

Due to the program's implementation, a concept of educational material was formed; a methodology for presenting scientific information was prepared; a technology of its implementation was developed; a pedagogical experiment was conducted as a logical continuation of theoretical research and checking their reliability, assessing the effectiveness and practical significance of the program.

4. Program of science popularization for international students

For many decades, NTU "KhPI" pays great attention to the popularization of science among international students. Thus, international students are given the maximum timely assistance in adapting to a new socio-cultural environment in order to achieve comfortable integration into the Ukrainian scientific and educational environment, as well as in assimilating new methods of obtaining scientific knowledge.

Most foreign citizens have a low level of awareness of science in general and scientific activity in Ukraine, in particular. Therefore, at the first stage of the program's implementation, special conditions for the elimination of the above-mentioned complexities should be provided.

It is well-known that due to differences in cultures and national mentality, there specifics in different spheres of life, including the perception of the scientific research significance. In addition, some differences in people interaction, manner of communication, and doing business in scientific area are reflected in all life spheres, so knowledge of these differences significantly affect the success of the popularization of science among foreigners.

In our opinion, the program of science popularization for international students should begin immediately after their arrival in Ukraine.

That's why, "Acquaintance Lessons" were created by professors of the Department of Natural Science of NTU "KhPI". There are acquaintance with the most important scientific objects of NTU "KhPI" and other Kharkiv universities; special classes in English, French and other languages for informing about

Ukrainian higher educational establishments, research organizations and programs for supporting foreigners in their further scientific and educational activities. Moreover, foreigners-freshmen are invited to the educational-adaptation course "Peculiarities of scientific research", which aims to provide international students with key knowledge about modern scientific developments of NTU "KhPI" with real practical effect, and, at the same time, familiarity with the system of scientific research in Ukraine.

To determine the effectiveness of the presented program, a pedagogical experiment was conducted. Two groups of international students took part in the experiment: one of them was an experimental (with the program of popularization of science learning) and the other was a control group (without the proposed program learning).

The pedagogical experiment was conducted for two years and consisted of three stages: establishing, forming and comparative.

208 international students and postgraduates from NTU "KhPI" were involved in various types of research and experimental work. Due to the establishing experiment, the problems related to the latest information technologies, environmental problems, and globalization of the economy were systematized; the level of students' awareness in engineering activities was determined. To solve these problems, a website for online forums, where students and experts could express their views on the issues listed above, was created [11].

The toolkit for research was questionnaires and surveys. The essence of the questionnaire developed specifically for international students, was to clarify their level of awareness of and willingness to participate in scientific and technical activities in Ukraine and in other countries.

The questionnaire contained 28 questions specified the attitude of foreigners to the following problems: 1) necessity of science popularization among foreigners in Ukraine; 2) knowledge in different areas of engineering activities for choosing future speciality in Ukrainian university; 3) dependence between the effectiveness of technical activity and professional ethics norms; 4) necessity in training courses "Science in Ukraine" and "Science at NTU "KhPI" and others. Respondents had to choose one of the four response options: "Yes", "No", "Sometimes", "I do not know". The analysis of the answers is shown below (Table 1).

Table 1. International students' answers

№	Issue	Respondents' answers (%)			
		Yes	No	Some-times	I don't know
1	Necessity of science popularization among foreigners in Ukraine.	28	10	46	16
2	Knowledge in different areas of engineering activities for choosing future speciality in Ukrainian university.	20	25	15	40
3	Dependence between the effectiveness of technical activity and professional ethics norms.	10	20	55	15
4	Necessity in training courses "Science in Ukraine" and "Science at NTU "KhPI".	62	8	10	10

The given structure of responses testifies that international students consider that receiving more profound information about scientific achievements and science while their university training is very important. However, they do not have a complete idea and integral concept about the importance of science popularization. The analysis of the answers to the proposed problems confirms the relevance of the development of methodological issues on the promotion of science in Ukraine, whose research is being carried out by an increasing number of scholars.

At the stage of the establishing experiment, the students' opinion was also clarified about following issues: "What additional training courses do you consider useful for studying in the process of training at the university": "Science in Ukraine", "Science at NTU "KhPI", "The phenomenon of Ukrainian scientists", "Prospective specialties in NTU "KhPI", "Your proposal". These questions caused some difficulties for international students, although the answers were rather monotonous: 22% of students supported the course "Science at NTU "KhPI", 20% – the course "Prospective specialties in NTU "KhPI", 20% – the course "Science in Ukraine", 16% – the course "The phenomenon of Ukrainian scientists", 22% – did not give any preferences for any course (Figure 1).

The results of the analysis of the establishing stage allowed making conclusion about little awareness of international students' regarding achievements, problems and significance of scientific research.

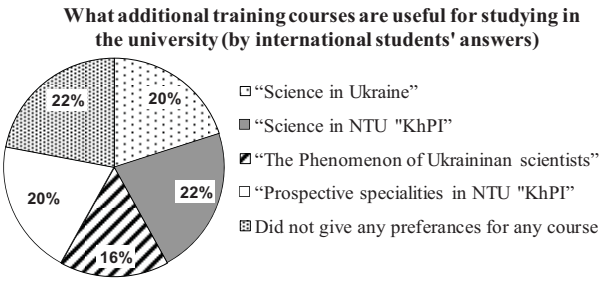

Figure. 1. Answers of international students of NTU "KhPI" to the question "Which additional training courses you consider expedient to study in training technical specialists at the university"

The next stage of the study was the forming experiment. The tasks of the forming stage of the pedagogical experiment were as follows: acquaintance of international students with the basic concepts of international scientific research; analysis of the main theoretical positions on the science popularization, developed both on foreign and Ukrainian base; identification of appropriate variants of science popularization among international students in Ukraine. To conduct the forming stage of the experiment, interactive courses "Features of scientific research", "Science in Ukraine" and "Science in NTU "KhPI" were developed, the educational tasks based on investigation real science issues were formed.

Educational material was developed in the form of interactive lectures and cases. Students received information about the history of the certain technical devices invention, as well as about the actual problems that modern scientists are trying to solve.

The material of the lectures and cases was not burdened with formulas and specific scientific terms; the process of creating a certain technical tool was based on a statement of what key scientific problems existed at each stage and whom and how they were solved. All these were contributed to raising the interest of the audience to science popularization. In addition, some lectures and practical classes were conducted in the form of "round tables" with participation of international postgraduate students of NTU "KhPI" and other higher educational Ukrainian institutions.

At the stage of the forming experiment, the following events were also carried out:

a) international students' conferences with discussion of modern scientific developments' practical significance;

b) meeting with well-known scientists who have made a significant contribution to the development of science;

c) excursions to the Kharkiv scientific museums;

d) excursions to the leading departments of the NTU "KhPI" with demonstration of their scientific achievements.

The NTU "KhPI" international students' scientific community was created, and foreigners from Ukrainian higher educational institutions have possibility to share their experience of training, answer questions, provide consultations etc. through the Faculty of International Education NTU "KhPI" Facebook [12-13].

The final stage was a comparative experiment, the essence of which was the attitude of learning outcomes in experimental and control groups. The instrumental tool of the comparative stage of the experiment was psychological and pedagogical diagnostics, which was conducted before studying the course in experimental groups and after its completion. International students gave answers to the same key problems associated with the popularization of science, which were offered to them for analysis at the stage of an establishing experiment.

According to the plan, two diagnostic sections in two groups of respondents were conducted: before and after completion of the pedagogical experiment. At the beginning of the experiment, the groups did not differ much in terms of cognitive activity: one third of students had low levels of educational activity, demonstrated passivity and apathy, and reluctance to leave the hostel. After implementation the proposed program in the experimental group, the percentage of international students with a high level of activity increased from 17 to 33%, the

percentage of international students with an average level of activity increased from 47 to 62%, and the percentage of international students with a low level of activity decreased from 36 to 5%. The situation in the control group remained almost unchanged.

The obtained results of the experiment indicate that the program of popularization of science among international students contributes to increasing their level of educational activities, and acceleration of the process of adaptation to new conditions.

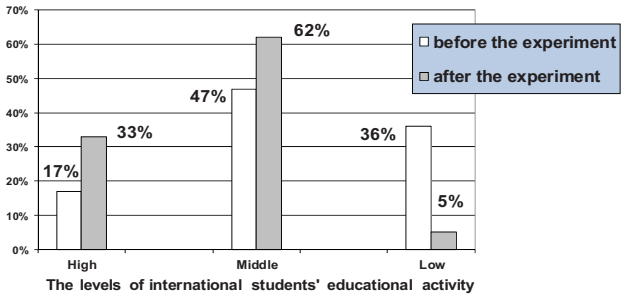

Figure 2. Comparison of the experiment's results before and after the program of popularization of science implementation

5. Conclusions

A program of popularization of science among international students will be useful for solving following tasks:

- increasing the number of international students who will be actively engaged in postgraduate and doctoral studies;
- international students' involvement in further scientific activity and continuation of appropriate training;
- promoting education at Ukrainian universities for those young people who are just about to come to Ukraine to study;
- increasing an intercultural competen-ce of all participants.

Teachers, sociologists, specialists in technical and natural sciences should be involved in activity regarding preparing educational materials for the program of science popularization implementing. Furthermore, there is a strong necessity to study the forms and methods of science popularizing used in world practice. Technologies of implementation the proposed program provide several areas of preparatory work: development of the necessary training materials, teachers' training, and using different forms of multimedia presentation and computer simulations.

6. References

[1] Hawking S. Kratchajshaja istorija vremeni/S. Hawking, L. Mlodinov. SPb.: Amfora, 2008.

[2] Hawking S, Mlodinow L. A briefer histo-ry of time. Reinbek: Rowohlt, 2005.

[3] Hawking S. Black holes and the information paradox. Proceedings of the 17th International Conference GR17, P. Florides P, Nolan B, Ottewill A (Eds.) 56-62, Dublin, Ireland, 2004.

[4] Hawking S. Sixty years in a nutshell. Prepared for Workshop on Conference on the Future of Conference: C02-01-07.7, 2002.

[5] Hawking S. The universe in a nutshell. New York: Bantam Spectra, 2001.

[6] http://mon.gov.ua/activity/mizhnarodni-zvyazki/uchast-u-programax-es-erazmus-ta-gorizont-2020/gorizont-2020.html

[7] https://www.researchgate.net/journal/0036-8733_Scientific_American

[8] http://www.alphagalileo.org/

[9] http://www.nature.com/nature/current_issue.html

[10] https://www.newscientist.com/

[11] http://pfkpi.8m.net/

[12] https://www.facebook.com/groups/1784765931750052/

[13] https://www.youtube.com/chanel/UCPvGRu2oK7ojDOgmItzsEWg